

UX Focused Development Work During Recent ORNL EPICS-Based Instrument Control System Upgrade Projects

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Instrument Data Acquisition and Controls

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Why does user experience (UX) matter?

Form **1040** Department of the Treasury—Internal Revenue Service **U.S. Individual Income Tax Return 2005** (L) IRS Use Only—Do not write or staple in this space.

For the year Jan. 1–Dec. 31, 2005, or other tax year beginning , 2005, ending , 20 OMB No. 1545-0074

Label (See instructions on page 16.) Use the IRS label. Otherwise, please print or type.

Your first name and initial Last name Your social security number

If a joint return, spouse's first name and initial Last name Spouse's social security number

Home address (number and street). If you have a P.O. box, see page 16. Apt. no. You must enter your SSN(s) above.

City, town or post office, state, and ZIP code. If you have a foreign address, see page 16. Checking a box below will not change your tax or refund.

Presidential Election Campaign Check here if you, or your spouse if filing jointly, want \$3 to go to this fund (see page 16) You Spouse

Filing Status

1 Single 4 Head of household (with qualifying person). (See page 17.) If the qualifying person is a child but not your dependent, enter this child's name here. ▶

2 Married filing jointly (even if only one had income)

3 Married filing separately. Enter spouse's SSN above and full name here. ▶ 5 Qualifying widow(er) with dependent child (see page 17)

Exemptions

6a Yourself. If someone can claim you as a dependent, do not check box 6a

b Spouse

c **Dependents:**

(1) First name	Last name	(2) Dependent's social security number	(3) Dependent's relationship to you	(4) <input checked="" type="checkbox"/> if qualifying child for child tax credit (see page 19)

d Total number of exemptions claimed Add numbers on lines above ▶

Income

7 Wages, salaries, tips, etc. Attach Form(s) W-2 7

8a **Taxable** interest. Attach Schedule B if required 8a

b **Tax-exempt** interest. Do not include on line 8a 8b

9a Ordinary dividends. Attach Schedule B if required 9a

b Qualified dividends (see page 23) 9b

10 Taxable refunds, credits, or offsets of state and local income taxes (see page 23) 10

11 Alimony received 11

12 Business income or (loss). Attach Schedule C or C-EZ 12

13 Capital gain or (loss). Attach Schedule D if required. If not required, check here 13

14 Other gains or (losses). Attach Form 4797 14

15a IRA distributions 15a b Taxable amount (see page 25) 15b

16a Pensions and annuities 16a b Taxable amount (see page 25) 16b

17 Rental real estate, royalties, partnerships, S corporations, trusts, etc. Attach Schedule E 17

18 Farm income or (loss). Attach Schedule F 18

19 Unemployment compensation 19

20a Social security benefits 20a b Taxable amount (see page 27) 20b

21 Other income. List type and amount (see page 29) 21

22 Add the amounts in the far right column for lines 7 through 21. This is your **total income** ▶ 22

Adjusted Gross Income

23 Educator expenses (see page 29) 23

24 Certain business expenses of reservists, performing artists, and fee-basis government officials. Attach Form 2106 or 2106-EZ 24

25 Health savings account deduction. Attach Form 8889 25

26 Moving expenses. Attach Form 3903 26

27 One-half of self-employment tax. Attach Schedule SE 27

28 Self-employed SEP, SIMPLE, and qualified plans 28

29 Self-employed health insurance deduction (see page 30) 29

30 Penalty on early withdrawal of savings 30

31a Alimony paid b Recipient's SSN ▶ 31a

32 IRA deduction (see page 31) 32

33 Student loan interest deduction (see page 33) 33

34 Tuition and fees deduction (see page 34) 34

35 Domestic production activities deduction. Attach Form 8903 35

36 Add lines 23 through 31a and 32 through 35 36

37 Subtract line 36 from line 22. This is your **adjusted gross income** ▶ 37

For Disclosure, Privacy Act, and Paperwork Reduction Act Notice, see page 78. Cat. No. 12600W Form **1040** (2005)

Jane, your 2018 federal return was accepted!

Download/print return

\$1,612 TOTAL 2018 TAX REFUND

16 FEDERAL E-FILE ACCEPTED

\$585 CA STATE E-FILE ACCEPTED

See all my returns

Federal return transmitted: 02/07/19

Federal return accepted: 02/07/19

Estimated federal refund date: 02/28/19

We're with you all year. Here's what you can do next:

See where you truly stand financially

Do you know the three numbers that matter to your financial health?

See your numbers FREE

72k

720

25%

Help others with AnswerXchange

Help another tax filer get their questions answered.

I can help

From: https://en.wikipedia.org/wiki/IRS_tax_forms#/media/File:Form_1040,_2005.jpg

<https://ttlc.intuit.com/community/prior-year-return/help/how-do-i-get-a-copy-of-a-return-i-filed-this-year-in-turbotax-online/00/25932>

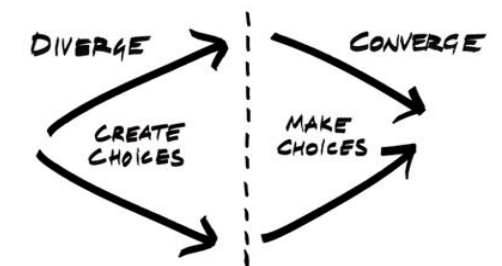
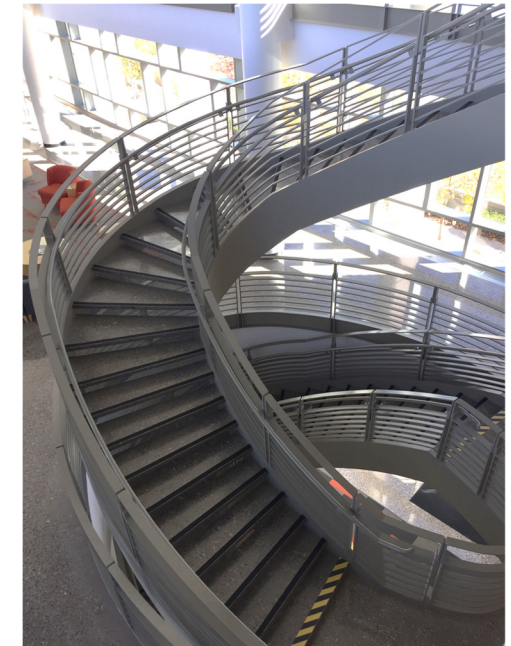
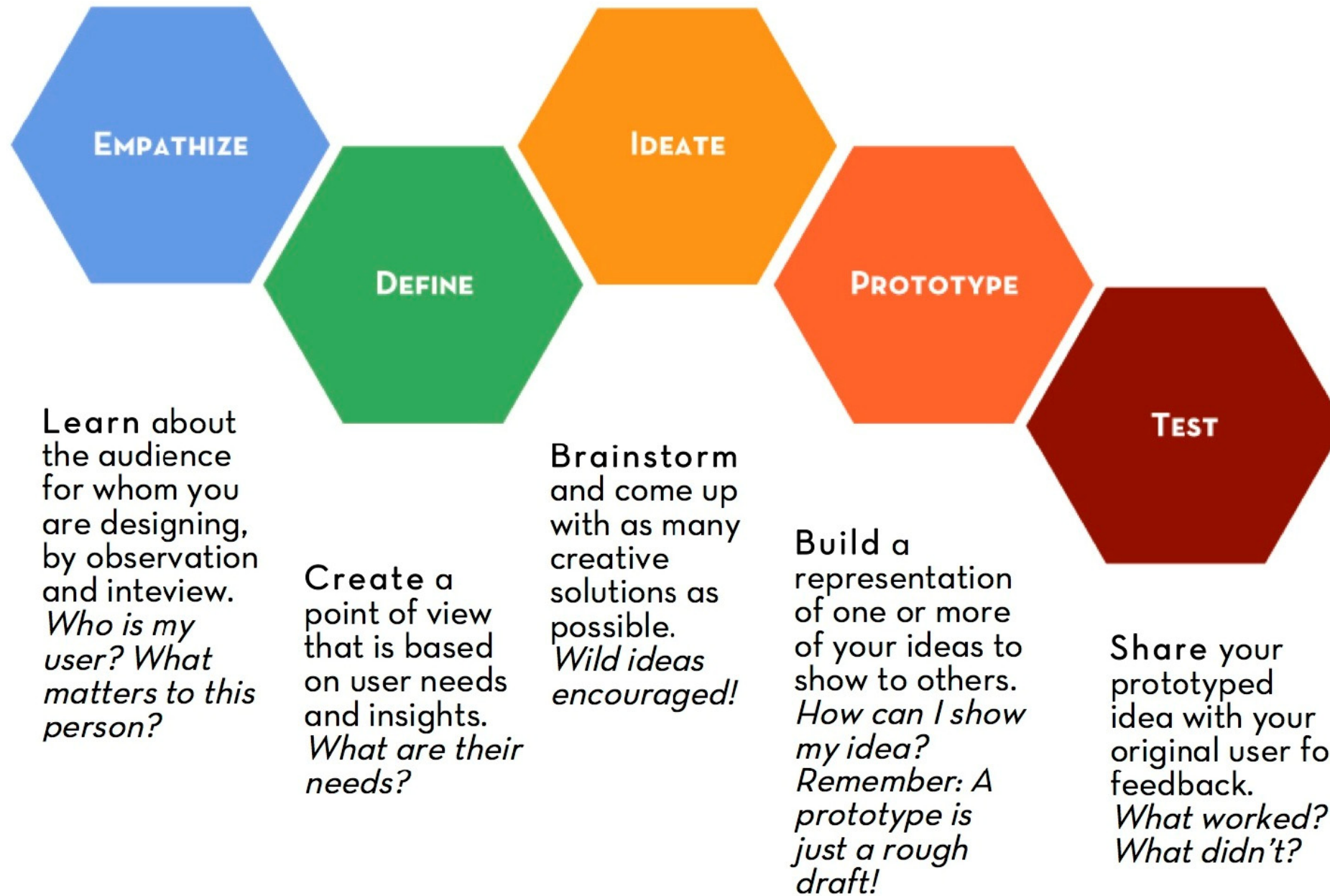
Outline

- Introduction
 - Interpret UX using Cost-Benefit Analysis analogy
 - Design thinking process
- Effective Methods and Practices
- Main Categories of UX/UI Deliverables

Interpret UX using Cost-Benefit Analysis analogy

- Cost
 - Physical effort (e.g. a mouse move/click, typing)
 - Mental effort (e.g. remembering, thinking)
 - Emotional effort (e.g. previous experience, perceived task difficulty, look-and-feel)
- Benefit
 - Get tasks done
 - Delightful, enjoyable experience
- Ultimate goal: **decrease cost/effort** and **increase benefit** for our users!

Design thinking process



From: <http://rawagency.se/wp-content/uploads/2015/11/Design-thinking.jpg>

<https://uxthink.files.wordpress.com/2010/01/picture-26.png>

Effective Methods and Practices

- Field studies/user interviews
- Focusing on clarifying and improving experiment processes
- Collaborating, collaborating, collaborating



Field studies/user interviews

- With **a beginner's mindset** and with **an empathetic attitude**
 - Complex systems: sample environment devices, choppers, motion control, detectors, etc.
 - Various levels of knowledge and skills: neutron scattering techniques, the beamlines users work at, and computer programming
 - Potential distractions: overwhelming amount of information, noise, time pressure, unfamiliar terminologies, operating system, data format, etc.
- **Motivate developers** to identify and address usability issues!

Focusing on clarifying and improving experiment processes

- Two distinctive types of data acquisition needs:
 - Routine needs with some established processes
 - Innovative needs which explore unique ways to use a beamline and incorporate new techniques

Some of the innovative needs may become routine needs later!

Collaborating, collaborating, collaborating

- Internally
 - Developers within Instrument Data Acquisition and Controls group
- Externally
 - Scientists and scientific associates
 - External users
 - Kay and all CS-Studio developers
 - Other supporting groups

Main Categories of UX/UI Deliverables

- Meaningful live displays
- Instrument Q configuration planning and handling tools
- Experiment automation tools



Meaningful live displays - Dashboard

Instrument Status

Beam Power (kW)
1398.22 kW

Scan Alarm
No Alarm

Primary Shutters

Align Scan Alarm Enabled

DGS Crystal Align Nested Loops

Proposal Information

Proposal #: IPTS-22777

Proposal Title: Crystal field measurements of the gamets R3Ga5O12 (R = Nd, Pr)

Team Members: 9QG;GQS;HDZHOU1978 (XCAMS/UCAMS)

Sample Temp: 7.8811 K

Run Information

Scan Status: Scanning

Run Status: Run

Run Number: 121644

Run Time: 708 s

Neutron Counts: 1228648

Count Rate (counts/s): 1753

Int. Proton Charge: 0.9760 C

Motor Information

Collimator: Out

Oscillating State: Stationary

STOP MOTORS (except Collimator)

Slit2 - Centers and Gaps Slit2 - Blades

S2 H Center:	-0.0000	-0.0000 mm
S2 H Gap:	11.9999	11.9999 mm
S2 V Center:	1.5000	1.5000 mm
S2 V Gap:	36.9999	36.9999 mm

Attenuator 1: Out Of Beam

Attenuator 2: Out Of Beam

Omega: 5.0000 5.0164 deg

Chopper Information

Energy (meV): 120.000 meV

Chtrans: Chopper2

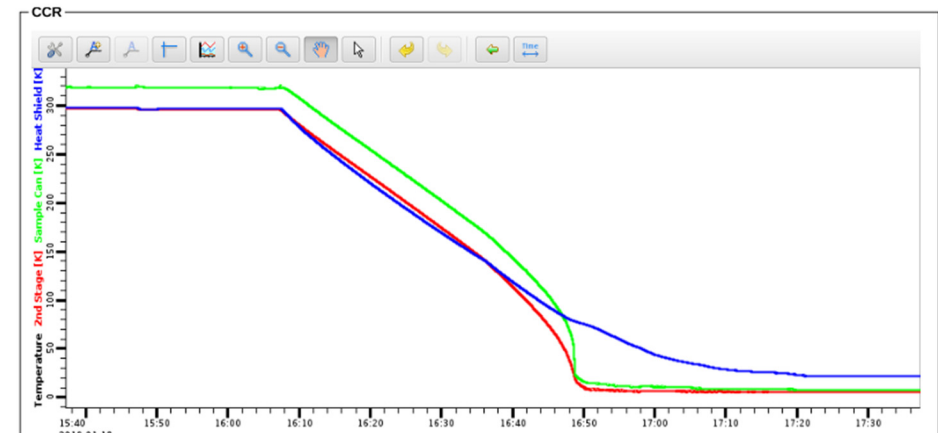
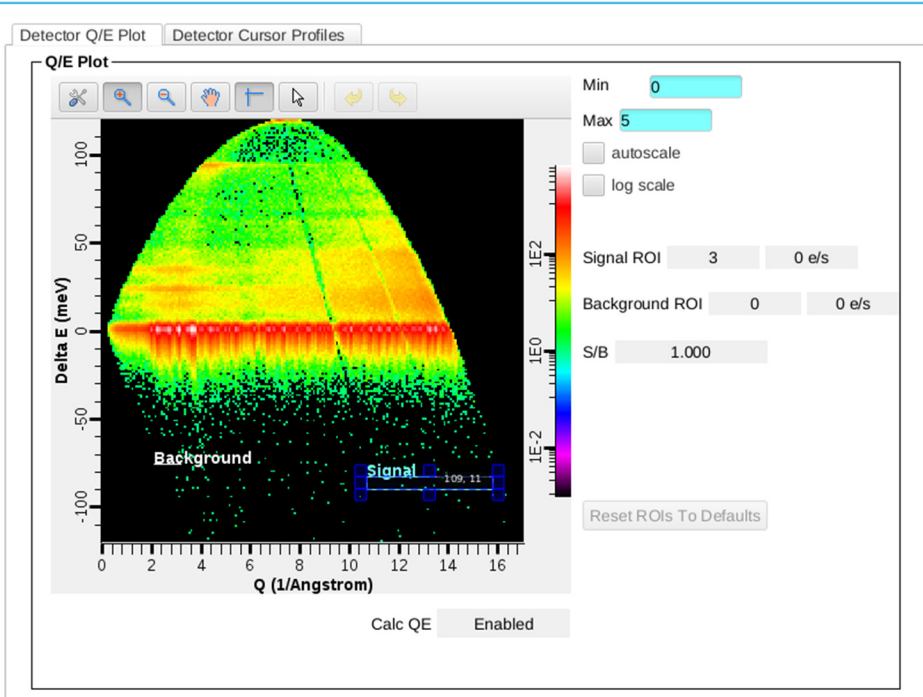
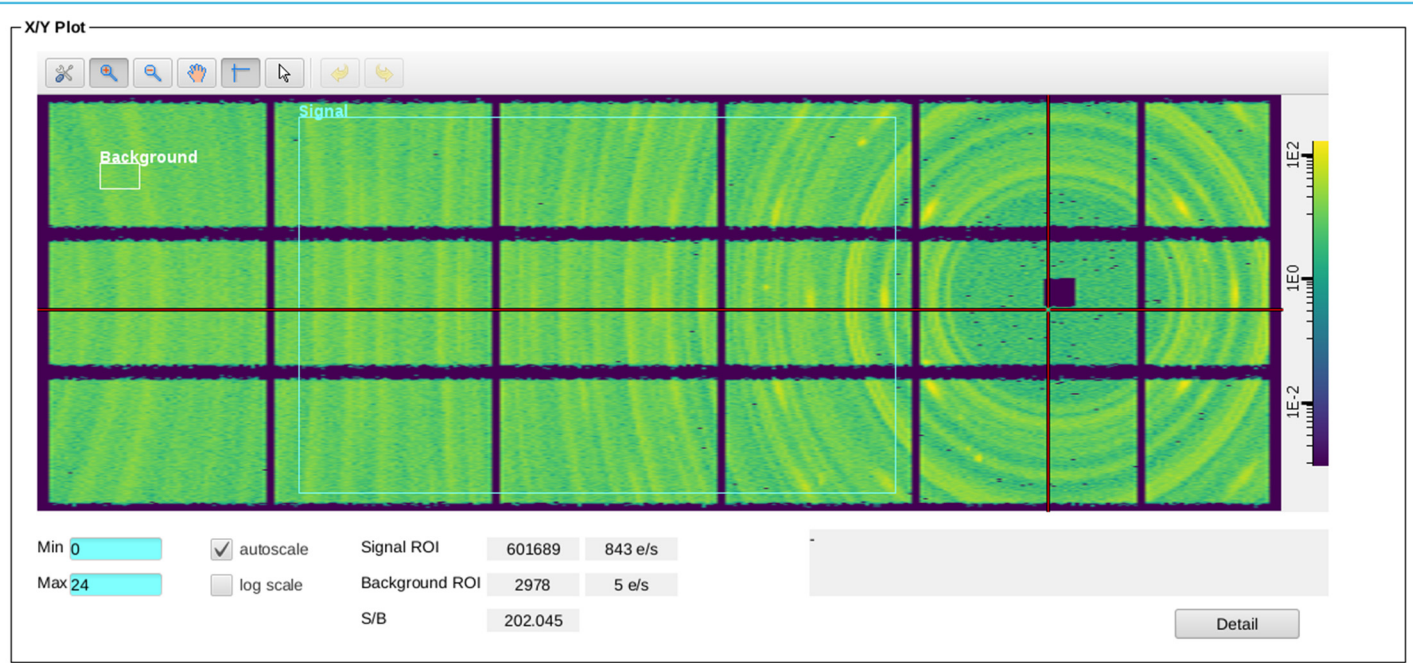
Mode: Automatic

Chopper Speed:

T0: 150 Hz

Fermi 1: 120 Hz

Fermi 2: 600 Hz



Lakeshore

Sample	Cold Finger	Heat Shield
7.881 K	5.441 K	0.000 K
Setpoint (K)	5.000 K	0.000 K
Tolerance (+/- K)	2.0	2.0

CCR Alarm

Sample Rotation

Motor BL18:Mot:Sample:Axis1

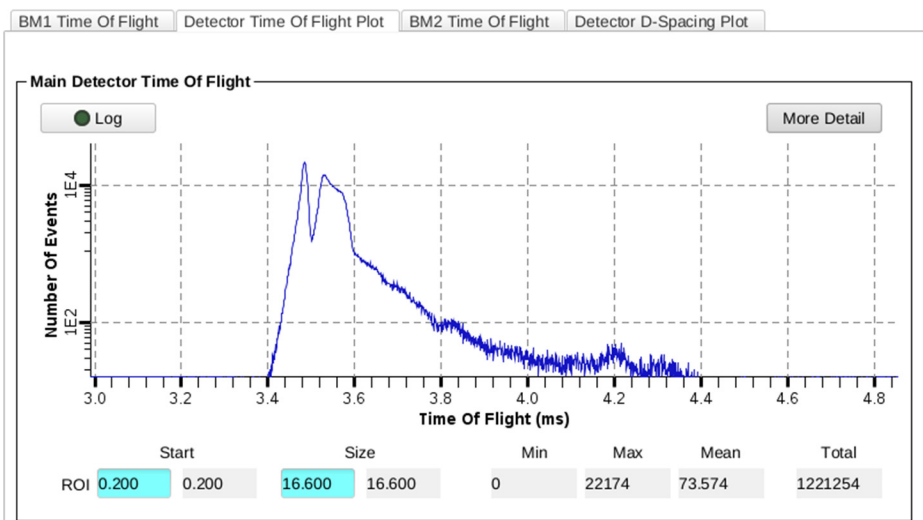
CCR12 Rotation

5.0164 deg STOP

5.0000 deg

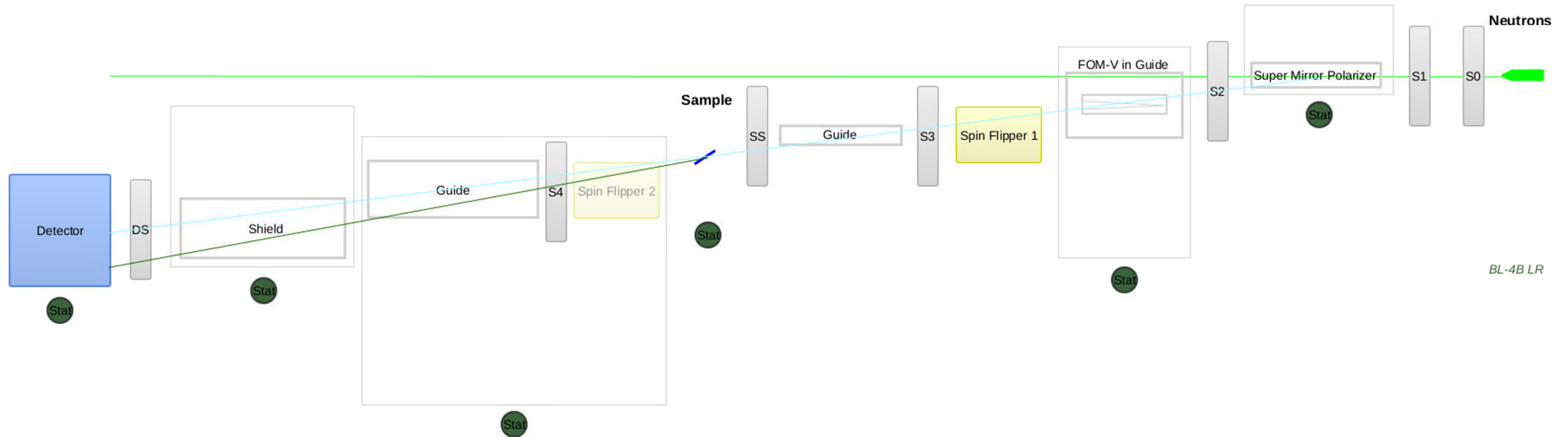
Tweak 1.0000 deg More

Yellow Box



Meaningful live displays – Instrument Status

BL-3 SNAP



BL-4B LR

Sample Environment Devices:

- | | |
|--------------------|-----------------------------|
| Bruker Magnet | Keithley High Voltage |
| Magnet H (5 Tesla) | Keithley Low Voltage |
| CCR 11 | High Voltage (up to 2 KV) |
| CCR-High Pressure | Six Position Sample Changer |

Chopper Frequency:

Instrument Q configuration planning and handling tools

1. Set Up Experiment
2. Align Sample
3. Calc Slits and Angle Resolution
4. Preview Q Range
5. Acquire Data

Reflectivity Calculation

Delta Theta: 0.01158

Front SLD: 0.000

Back SLD: 2.000

Layer SLD: 4.500

Thickness: 120.000

Qmin to Measure (1/Angstrom): 0.01000

Qmax to Measure (1/Angstrom): 0.25000

numpy.logspace num: 500

Q Planning

ThetaMin: 0.3344 degree

Use SANGLE: 3.9088 deg

Lambda center: 5.350 Angstrom

Lambda width: 5.500 Angstrom, at 30.0 HzHz

Q overlapping rate: 40.000 %

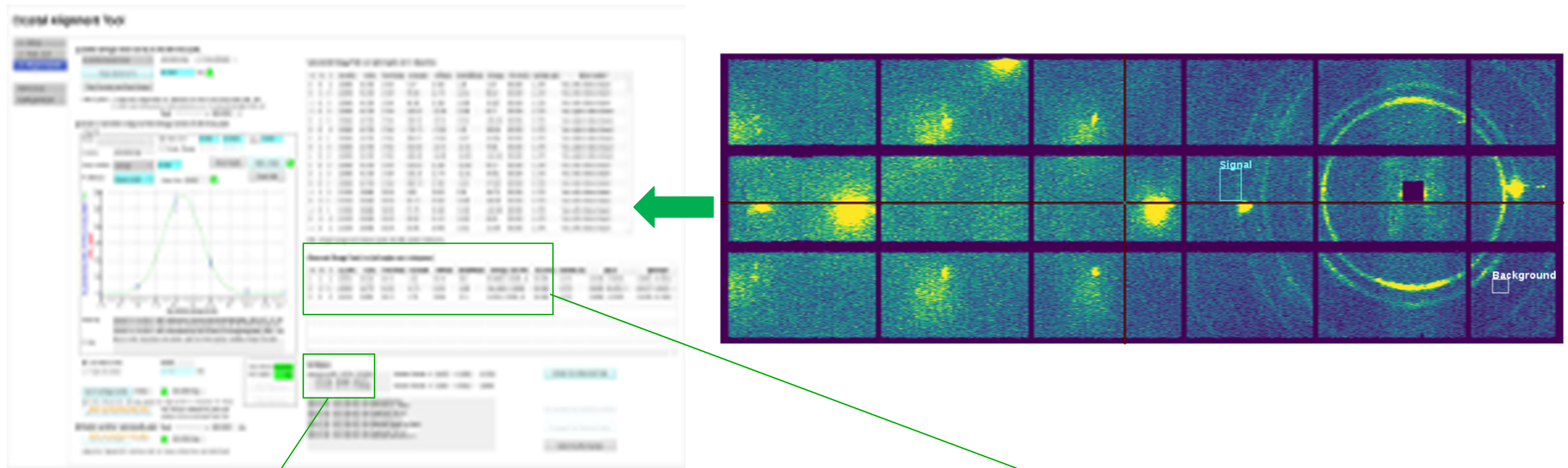
NTheta factor: 2.500

Qmin(s) Qmax(s)

Theta	Qmin	Qmax	NTheta
0.3343	0.0091	0.0282	nan
0.7586	0.0205	0.0640	2.2692
1.7214	0.0466	0.1452	2.2692
3.9058	0.1058	0.3292	2.2689

BL4A:CS:ExpPlan:RArray

Experiment automation tools – CrystalAlign



Observed Bragg Peak List (all angles are in degrees)

h	k	l	Q (1/Å)	d (Å)	TwoTheta	Azimuth	InPlane	OutOfPlane	Omega, Chi, Phi
1	-1	-1	2.5981	2.4184	30.67	2.15	30.66	1.10	58.8491, 0.0000, 0...
2	-2	0	4.2403	1.4818	51.14	-0.35	51.14	-0.27	104.2920, 0.0000, ...
0	0	-2	2.9836	2.1059	35.37	4.07	35.30	2.36	6.2219, 0.0000, 0...

UB Matrix:

```
array([[[-0.0449, 0.0214, 0.2346],
        [ 0.1716, 0.1666, 0.0177],
        [-0.1614, 0.1711, -0.0465]])
```

Experiment automation tools – Operating Modes

1.2 Sample Environment Device and Operating Mode

- NO Special SE Devices
 - Robot
 - Liquid/Solid Cell
 - Electrochemical Cell
 - Rheometer
 - Multi-Environment Chamber
 - Langmuir Trough
 - Flow/Shear Cell
- Free Liquid - zs

1.3 Align sample BEFORE collecting direct beam data?

- Yes No

Substrate thickness: mm

Change Mode Only: **Reflectivity** **Direct Beam**

Instrument Status		
Choppers Phase Locked	<input checked="" type="radio"/>	OK
Motors Status	<input checked="" type="radio"/>	Busy?
SE Device	Langmuir Trough	
Operating Mode	Free Liquid	
Motor Positions	0 (0: Sample; 1: Direct B)	

Operating Status
Is the instrument busy?
Dk Green: NO
Orange: YES

Experiment automation tool

1. Set Up Experiment
2. Align Sample
3. Calc Slits and Angle Resolution
4. Preview Q Range
5. Acquire Data

Direct Beam
Data
Mag/Temp/Sample Changer
Advanced Options

Spin Flipper States (Polarization States):

Off Off (Up Up)

On Off (Down Up)

Off On (Up Down)

On On (Down Down)

Repeat Step 1 (for total reflection) with: 5.350 Angstrom

New Calibration Table Use saved motor positions: Set 1

Calibrate

Submit

Shutters: ●

```

2019-03-20- 13:55:44 INFO Working on updating total time...
2019-03-20- 13:55:44 INFO ===Successfully updated total time===
2019-03-20- 13:55:45 INFO Set SelectedRow to -1
2019-03-20- 13:55:46 INFO ===Updated the table related PV===
2019-03-20- 13:55:46 INFO Working on updating total time...
2019-03-20- 13:55:46 INFO ===Successfully updated total time===
2019-03-20- 13:58:31 INFO ===Updated the table related PV===
2019-03-20- 13:58:31 INFO Working on submitting scan jobs...
2019-03-20- 14:20:14 INFO Set SelectedRow to -1
2019-03-20- 14:21:16 INFO Set SelectedRow to -1
                
```

Chopper Frequency: 30.000 Hz Total Time: 169.000 mins Update Total Time

Table: /tmp/Lakey/second.csv Enable Load ☑

Delete One Row Save Table Keep same number of loops Update Row Time

Print Table

Title	SeqTotal	SeqNum	Lambda	SampleX	SANGLE	DANGLE	S1HWidth	S2HWidth	S3HWidth	SSHWidth	RSlit4	LDetSlit	RDetSlit	Off Off (s)	On Off (s)	Time (min)
S1 bme: H2O	4	1	5.35	-4.68815	0.334394	2.004379	0.302100	0.299500	0.336000		-55.015930	-8.780815	-29.985085	61.0	77.0	5
		2			0.758600	2.852978	0.685338	0.679440	0.762243					61.0	150.0	14
		3			1.721396	4.778571	1.555153	1.541768	1.729663					61.0	84.0	50
		4			3.905761	9.147300	3.528563	3.498195	3.924519					61.0	61.0	100
Click to add r...																

...and the rewarding journey goes on! 😊

- **Acknowledgements**

- All beamline teams and external users we've worked with
- Kay and all CS-Studio developers
- All developers in IDAC group

